(12) UK Patent Application (19) GB (11) 2 083 726 A

(21) Application No 8127096
(22) Date of filing 8 Sep 1981
(30) Priority data
(31) 80/29058
(32) 9 Sep 1980
(33) United Kingdom (GB)
(43) Application published
24 Mar 1982
(51) INT CL[3]
H04N 1/22
(52) Domestic classification
H4F CQ S1 S21 S30K S40P
S42H S42M S42R9 S49W
S53M
(56) Documents cited
GB 1433025
GB 1284266
(58) Field of search
H4F

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(54) Preparation of multi-colour prints by laser irradiation and materials for use therein

(57) A process for preparing a full colour image in which three or more dyes carried on donor sheets are transferred to a receptor sheet by heating with a scanning laser beam to volatilise the dyes in which:

(i) the wavelength of the laser is less than 2.5 μ and preferably more than 0.2 μ,

(ii) each donor sheet comprises a support sheet substantially transparent to said laser beam, bearing on its major surface a dye layer comprising at least one dye which is vaporisable at a temperature in the range 120 to 250°C and a heat-resistant binder which is substantially transparent to said laser beam, each donor sheet having a material which strongly absorbs light at the output wavelength of the laser distributed throughout the dye layer and/or in a separate layer interposed between said major surface of the support and dye layer in an amount to absorb a substantial porportion of the incident laser radiation, and

(iii) the receptor is heated to a temperature of from 120 to 250°C at least after the final dye transfer stage, generally for a period in the range from 0.01 to 30 seconds, to stabilise the dye image.

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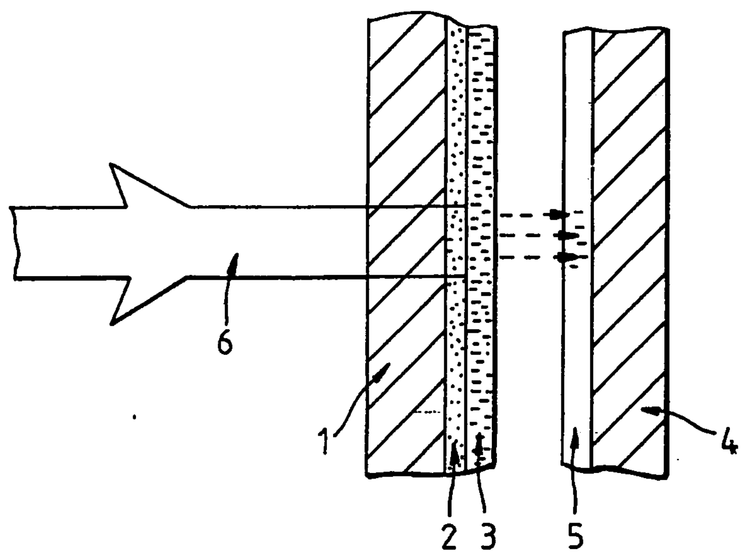
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SPECIFICATION

Preparation of multi-colour prints by laser irradiation and materials for use therein

This invention relates to a process for preparing a full-colour image of an object and to materials for use therein.

Full-colour images may be recorded by a variety of methods, for example, by magnetic tape video-recording, or on silver halide-based camera colour film. Final viewable colour hard-copy is produced from these records in a number of ways. In one method a certain proportion of silver halide colour film itself becomes the final viewable colour picture in the form of a colour transparency. In other methods a proportion of the recording film serves as an intermediate to produce either a silver halide-based colour print or an ink printed colour picture via colour separation, screening and lithographic or gravure printing.

In the sequence of operations necessary to produce an ink-printed, full-colour picture, a third type of full-colour picture may be made, the colour proof. Colour proofs are required to check the accuracy of the three or more screened or continuous-tone colour separations from which the final three or more colour printing plates or cylinders are made. Colour-proofing systems are often based on non-silver halide light-sensitive coatings, usually polymer systems, and require many exposure and processing steps before a final, full-colour picture is assembled.

British Patent Specification Nos. 1 308 116 and 1 433 025 disclose methods of printing coloured images by superimposing individual colour component images in which a dye-image receptor sheet is placed in contact with a donor sheet bearing a dyestuff which sublimes or vapourises at 160 to 220°C and the donor sheet is heated by irradiation with a laser beam so that the dyestuff is raised to its sublimation or vapourisation temperature and is transferred to the receptor in a pattern corresponding to the individual colour component image, the laser beam being controlled by signals which are representative of the coloured original; the transfer process being repeated for each colour component. The donor sheet may comprise plastics film upon which the sublimable dyestuffs are coated or printed. The dye layer may also contain a material which absorbs the laser beam strongly in order to increase the efficiency of the transfer and the receptor sheet may be warmed to a temperature approaching the sublimation temperature of the dye prior to or during irradiation by the laser. Suitable lasers include CO_2 lasers functioning at 10.6 μ. These sublimation transfer printing processes have been used to provide multi-coloured images on synthetic sheet material, including textile webs and plastics film, plastics coated and unprocessed paper. However, it has been found that there are many parameters which affect the quality of the image obtained by a sublimation transfer process and whilst the image quality is generally acceptable for printing textiles and the like, the known processes do not appear to be capable of providing full tonal range, full sharpness photographic quality images.

It is an object of the present invention to provide an improved process for preparing full-colour images of an object.

According to the present invention there is provided a process for preparing a full-colour image of an object on a receptor sheet which comprises analysing the object to obtain a set of signals which is representative of the shape and colour of the object, sequentially contacting three or more dyes carried on donor sheets with the receptor sheet and transferring said dyes imagewise onto the receptor sheet to form a full-colour image of the object, the dyes being transferred by heating with a scanning laser beam to volatilise the dyes, the laser beam being modulated by said set of signals which is representative of the shape and colour of the object so that each dye is heated to cause volatilisation only in those areas in which its presence is required on the receptor sheet to reconstruct the colour of the object, characterised in that:

(i) the wavelength of the laser is less than 2.5 μ and preferably more than 0.2 μ

(ii) each donor sheet comprises a support sheet substantially transparent to said laser beam, bearing on its major surface a dye layer comprising at least one dye which is vaporisable at a temperature in the range 120 to 250°C and a heat-resistant binder which is substantially transparent to said laser beam, each donor sheet having a material which strongly absorbs light at the output wavelength of the laser distributed throughout the dye layer and/or in a separate layer interposed between said major surface of the support and dye layer in an amount to absorb a substantial proportion of the incident laser radiation, and

(iii) the receptor is heated to a temperature of from 120 to 250°C at least after the final dye transfer stage, generally for a period in the range from 0.01 to 30 seconds, to stabilise the dye image.

The process of the present invention may be used to prepare a full-colour picture suitable for use as a final viewable print, i.e. to replace a conventional photographic silver halide colour print, or for use as a colour proof in ink-printed colour reproduction processes. The full-colour pictures may be prepared according to the invention without the use of light-sensitive coatings and do not require the many processing steps often associated with the prior art.

The invention takes advantage of the increasing use of scanned, modulated laser-beams to imagewise expose radiation-sensitive materials. Since the output of laser scanners is controlled by electronic signals, these may be derived from any suitable source, e.g. a reading head scanning a colour film positive, negative or print, or from a magnetic recording tape, disc or the like. Thus, with suitable processing either conventional colour photographic or video-recorder input may be used. Thus, the initial analysis of the object to obtain a set of signals which is representative of the shape and colour of the object, will be

performed using a wide range of currently available equipment, which is selected according to the nature of the object to be recorded, e.g. photograph, transparency, negative, document or natural scene.

A full-colour picture is prepared in accordance with the invention by image-wise transferring three or more dyes from donor sheets onto a single receptor sheet by means of the heating effect of an image-modulated, scanned laser beam. The colours of the dyes are selected so that all the colours of the spectrum may be reproduced by suitable combinations of the dyes. Generally, the dye colours used are the subtractive primaries cyan, magenta and yellow, commonly used in photographic colour processes to provide full natural colour. Black colour may be achieved by suitable mixture of dyes, and in some cases an additional donor sheet for transferring black colour may be desirable.

It has been found that a particular form of donor sheet in combination with specific process parameters will provide a full-colour image by vapour transfer using lasers which is of photographic definitition, i.e. the resolution of detail is at least equivalent to 8 to 10 lines per millimetre which is the generally accepted higher resolution limit of the unaided eye at near distance. One of the important features of the process is that a laser having an emission wavelength of less than 2.5 μ and generally in the range 0.2 to 2.5 μ is used. The use of a laser emitting in this region has a number of advantages. Firstly, the emission wavelength is several times shorter than the CO_2 laser which emits at 10.6 μ and is generally used in sublimation transfer processes, and accordingly it may be focussed to a smaller dot size, thus giving better image definition and resolution. A further advantage is that the donor support sheet and associated binder are substantially transparent to the laser light. Thus, the light passes through the support without heating it, thereby eliminating any thermal spread of the image which would result if the support sheet were heated.

In one aspect of the invention the wavelength of the laser emission and the dyes are selected so that the dyes are transparent to the laser light. In general, most organic materials are transparent to a laser emission in the range 0.75 to 2.5 μ. Whilst it may appear undesirable that the dyes do not absorb the laser light to become heated to their volatilisation temperature, in practice there are certain advantages which are obtained by the use of dyes which are substantially transparent to the radiation as will be explained hereinafter.

The donor sheet includes a material which strongly absorbs the wavelength of the laser and accordingly when irradiated this material is strongly heated and transfers the heat to the dye in the immediate vicinity thereby heating the dye to its vaporisation temperature. The absorbent material may be present in a layer beneath the dye and/or it may be admixed with the dye.

It has been found that such donor sheets may be readily tuned to the processing laser in order to ensure the required transfer of dye by varying the amount of absorbent material on the donor sheet. One of the problems associated with relying upon the dyes themselves to absorb the laser emission to become heated to their volatilisation temperature is that different dyes have different absorptions and accordingly the selection of dyes to use with a particular system is critical in order to obtain the required transfer rate from each donor sheet. The absorbent material may be in the form of finely divided particles or a continuous film.

It is not essential that each of the dyes be transparent to the laser emission and when wavelengths in the visible region are used it is probable that one of the dyes will absorb strongly. However, it has been found that the presence of the absorbent material absorbs the major amount of the laser emission and if present in an underlayer may absorb substantially all the laser emission and accordingly it is readily possible to obtain the required balanced transfer rate from each donot sheet in spite of the fact that one of the dyes may absorb the laser emission.

A suitable laser for use in the present invention is the Nd:YAG laser emitting at 1.06 μ. This type of laser is commercially available, has high reliability and relatively high efficiency and is available in suitable powers in the range 10 to 30 watts.

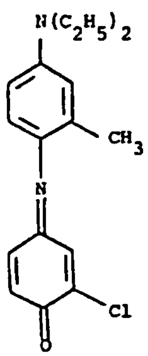
The material which is highly absorbent of the laser emission is not transferrable under the conditions of the dye transfer. Suitable materials include non-volatile dyes or pigments having a high absorbence at the laser emission utilized. A suitable material which is highly absorbent of the laser emission is carbon. Carbon is cheap and readily available in fine particle size, it is an efficient absorber and it is non-volatile and non-softening in the temperature range of dye volatilisation. An additional advantage of carbon is that it is a broadband light absorber, absorbing throughout the near UV, visible and near infra-red parts of the spectrum. Therefore, a change of exposing laser emission wavelength within these regions does not require major reformulation of the dye-donor sheets.

The absorbent material may be coated as a separate layer in an organic binder upon the support sheet and/or may be included dispersed in the dye layer. The use of a separate layer has advantages in that the layer provides a focussing point for the laser and is tolerant of over exposure without transfer of carbon to the receptor. A single layer containing dye and carbon intimately admixed is more sensitive than a two layer structure but less tolerant to over exposure. The amount of light-absorbent material is normally selected to absorb the major part, preferably at least 60%, of the incident laser-beam energy, for efficient utilisation of the laser. Thus, an absorbent content sufficient to give an optical density of 1.0 at the laser emission wavelength will absorb 90% of the incident energy, while a content giving an optical density of 2.0 would absorb 99%. Increase of absorber content above these levels becomes relatively cost-ineffective. Lower levels, giving less than 90% light absorption, may be indicated in some circumstances. The concentration of the absorbent material can be adjusted independently of the nature and quantities of other materials, i.e. dyes, binder and substrate, since these materials are transparent to the laser radiation, and accordingly the

vaporisation characteristics of the donor may be trimmed to the desired level by variation in the content of absorbent material.

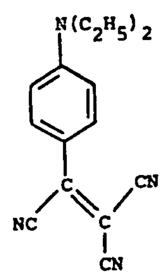
The donor sheets used in the invention comprise a base support sheet which is substantially transparent to the exposing radiation of the laser and sufficiently heat stable so as not to distort during the imaging cycle. Suitable materials for use as a support sheet include common plastics sheet materials such as polyester, polystyrene, polycarbonate and cellulose acetate, e.g. the materials commonly used as photographic bases. These materials are substantially transparent to the 1.06 μ emission of an Nd:YAG laser and accordingly heating of the support sheet is minimised during exposure to the laser beam.

The dyes used in the invention are chosen for suitable vaporisation characteristics and colour, compatibility with coating solvents, affinity with the surface of the receptor sheet and light-stability. The dyes are transferred in the vapour phase during the process and the transfer does not involve melting, change of adhesion or chemical structure of the dyes or associated ink vehicle, e.g. binder, wax, etc. There is a wide range of commercially available dyes which may be used which were developed for heat-transfer printing of textiles and the like. The preferred range of dyes are dyes which are sublimable in the temperature range 150 to 220°C. It is not essential that the dyes are strictly sublimable in as much as they pass from the solid to the vapour phase directly since the time period for heating is very small and accordingly it is possible to use dyes which under slow heating conditions would melt before entering the vapour phase provided that such dyes will transfer in the vapour phase only during the process without a liquid phase interfering with the transfer. Suitable dyestuffs include anthraquinones and azo dyestuffs. Other useful classes of dyes include indophenol, styryl and methin dyes. Any type of dye may be used which shows suitable volatilistion behaviour, is stable at volatilisation temperature and which provides the desired dye colours. Generally, the process of the invention will use a three colour system comprising a cyan, magenta and yellow dye. Examples of suitable dyes are as follows:



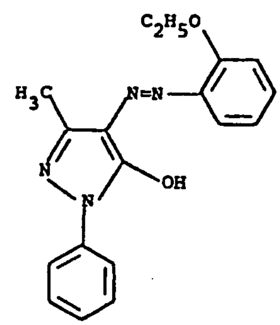
Cyan

Dye A



Magenta

Dye B



Yellow

Dye C

The dyes are coated onto the support sheet dispersed in a polymeric binder. The binder should be heat stable and high melting so that it does not soften appreciably during the imaging process and is transparent to the laser emission. Suitable binders include polycarbonates and cellulose ethers.

The receptor sheet for use in the invention should be heat stable. While receptor sheets may consist solely of plastics sheet material, such as polyester, or paper, it is preferable that the receptor is provided with a coating of a dye-receptive medium in order to aid dye penetration, fixation and the attainment of the correct dye hue. Such coatings may contain easily dyeable polymers such as polyvinyl pyridine or polyvinyl chloride, vinyl chloride/acetate copolymers, dye-fixing agents such as metal salts, and/or particulate absorbent materials such as silica.

The donor and receptor sheets must be held in contact during exposure. This may be achieved by applying mechanical pressure, e.g. by a pressure pad or by stretching the sheets around a cylinder, or by application of air pressure or vacuum. Mechanical pressure has been found to be adequate.

Exposure may be effected by a modulated focussed laser beam, e.g. Nd:YAG, scanned by mechanical or optical means. The power levels required are those sufficient to heat the dye carried on the donor sheet to a temperature and for a time necessary to volatilise the dye and effect transfer of the dye from the donor sheet to the receptor. The power levels are selected to avoid causing physical damage to the donor sheet or the receptor sheet.

It is important that the laser beam is accurately focussed in order to obtain good resolution and dye density. The correct focus point in the donor-receptor sandwich may be found by trial and error, by observing the quality of a transferred dye image. Mal-focus shows up not only as a less clearly defined image, but also as a variation in transferred dye density, and even as a transfer of unwanted material in addition to the required pure dye. In the case of a two-layer donor sheet, it has been found that a suitable focussing point is the layer of particulate carbon.

It has been found that the dye colour and dye-image permanence is enhanced by subjecting the receptor to a heat treatment at least after the final dye transfer stage and preferably after each dye transfer stage. The receptor is heated to a temperature of from 120 to 250°C for a time sufficient for the dye(s) to become stabilised into the surface of the receptor. The time period is generally in the range 0.01 to 30 seconds and in practice the receptor is generally heated to 160 to 180°C for from 0.5 to 1 seconds. Since this secondary heating of the transferred dye image is carried out after the dye donor sheet has been separated from the receptor, the duration and temperature of heating is not critical, since it can cause no unwanted dye transfer in background areas, which may occur if secondary heating is applied while the donor and receptor sheets are in contact.

The heat treatment may be carried out by contacting the face of the image receptor sheet with a platen or roller heated to a suitable temperature. The contacting face of the heating device being pressed onto the dyed receptor surface avoids loss of dye by evaporation into the atmosphere, which may be the case if the imaged receptor is heated from the back, or by a non-contacting heater from the front. The exact mechanism of "ironing-in" the dye image is not known although it is believed that the vapour transfer of the dye simply results in deposition of the dye on the surface of the receptor sheet without full absorption of the dye into the surface and the heating treatment drives the dye into the receptor surface and the dye presumably becomes molecularly dispersed therein. The result of the heat treatment is that the dye image attains its full and intended colour and density range, and is stable.

Using the above donor sheets and the process requirements, full-colour tonally correct, stable images can be made in a reasonable time using a suitable scanner. The images may be either in a continuous-tone mode, by varying the scanner laser output power continuously as a function of the colour information read from the scanner input original (or from an electronic signal derived from it), or in a screened mode by digitising the laser drive signal to transfer dots of equal density but varying size, as in half-tone printing.

The resulting image from the process of the invention may be varnished, laminated or may be retransferred, by heat or other means, to a second receptive surface and thus may be used for decorative purposes.

The process of the invention will now be described with reference to the accompanying drawing which is a diagram showing the donor and receptor sheets during exposure to laser emission.

The donor sheet consists of a support sheet 1 of plastics material coated with a carbon-containing resin layer 2 and then with a dye layer 3 containing a vaporisable dye in a resin binder. The donor sheet is placed in face-to-face contact with a receptor sheet consisting of a support sheet 4 of paper having a dye receptive coating 5.

The donor/receptor sheet sandwich is then scanned with a focussed Nd:YAG infrared laser beam 6 which has been modulated with the image information necessary to reconstruct those parts of the final receptor colour image which require the presence of the particular dye on the donor sheet. Where the laser beam strikes the carbon layer of the donor sheet, the 1.06 μ infrared radiation is absorbed and the carbon layer is heated in that region. The contiguous dye layer is thus heated to a temperature at which the dye volatilises, the dye is transferred to the surface of the receptor sheet where it condenses to form an image. The receptor sheet is then removed from the donor sheet and subjected to a heat treatment in the range 120 to 250°C to drive the dye into the receptor surface. The transfer and heating cycle is repeated for the desired range of dyes to form a well absorbed, stable full-colour image.

The invention will now be illustrated by the following Examples.

EXAMPLE 1

Dye-donor sheet - single layer coating

Donor sheets were prepared by knife coating polyester sheet with a 0.002" wet thickness layer of the following composition:

1 g volatile dye
20 g acetone
30 g of Solution A, and
10 g of Dispersion B.

Solution A comprised 10 g ethyl cellulose (Hercules N7) in 80 g toluene and 20 g ethanol.

Dispersion B comprised 5 g of carbon (Colombian Raven 1255) in 10 g ethyl cellulose (Hercules N7), 80 g toluene and 20 g ethanol.

The coated layer was allowed to air-dry.

Cyan, magenta and yellow donor sheets were prepared utilising Dyes A to C hereinbefore defined respectively. A black donor sheet was prepared utilising a balanced mixture of dyes A to C.

EXAMPLE 2

Dye-donor sheet - two layer coating

Polyester sheet was coated with a dispersion of carbon in an acrylic acid/acrylate copolymer solution to give an optical density to white light of approximately 1.0. On this dried carbon coating layer was knife-coated at 0.001" a dye solution containing:

1 g volatile dye (as in Example 1)
2 g polycarbonate resin (G.E. Lexan 141-111)
20 ml methylene dichloride

The coated layer was allowed to air-dry.

EXAMPLE 3

Receptor sheet

A bond-paper sheet was coated at 0.002" wet thickness with a dispersion comprising:

80 g ethyl methyl ketone
9.8 g vinyl chloride/acetate resin (Bakelite VYNS)
7.9 g silica (Hi-Sil 422 available from PPG Industries)
2.3 g nickel stearate

and allowed to dry.

EXAMPLE 4

Laser scanner full-colour picture formation - continuous tone

A positive photographic colour transparency was mounted on the input drum of a graphic arts scanner.

On the output drum of the scanner was mounted a sheet of receptor material as prepared in Example 3, face (coated) side out. A sheet of single-layer cyan dye-donor material prepared as in Example 1, was mounted on the receptor sheet, face side down. Contact was maintained by applying light tension to the dye-donor sheet.

The scanner drums were rotated at 800 rpm, and the photographic transparency on the input drum was scanned with a light source/filter/photocell combination to read the cyan image information contained in the transparency.

The dye transfer sandwich on the output drum was simultaneously scanned with a focussed Nd:YAG laser beam which was modulated by the signal derived from the scanner input read-head. The laser beam was controlled to provide approximately 3 watts of power on a focal spot of diameter approximately 60 μ for picture areas of maximum cyan density, with correspondingly reduced powers in areas of lower cyan densities. The laser beam scanned the dye-transfer sandwich at 16 lines per millimetre.

When the entire picture area had been scanned, the cyan dye donor sheet was removed from the receptor surface on the output drum, to reveal a cyan image on the receptor surface corresponding to the cyan image information in the original transparency. This image was then heated with a hot metal roller in order to ensure complete absorption of the transferred cyan dye image into the receptor surface. The cyan image then gave an excellent representation of the cyan content of the original transparency, with respect to density, tonal range, etc.

A magenta, single-layer, dye-donor sheet was then fixed over the receptor sheet, and once more the scanner was operated to select the magenta image information from the original transparency and to apply a corresponding magenta dye-transfer image to the receptor. The magenta dye-donor sheet was removed from the receptor sheet on the output drum, and the magenta image was reheated with a heated metal roller to ensure complete absorbtion into the receptor surface coating.

The process was repeated using a yellow dye-donor sheet to form the yellow parts of the receptor image. The receptor sheet then carried a full-colour reproduction of the original transparency. Image resolution was as good as, or better than, the higher spatial frequency limit of normal unaided vision. Image colours were saturated, tonal values correct, and the resulting full colour picture was stable.

The use of three colours, cyan, magenta and yellow, was sufficient to produce a full-colour picture suitable for most purposes. However, if a black impression is also required (as commonly used in four-colour lithographic reproduction) then a black dye-donor can be used in addition to the cyan, magenta and yellow dye-donor.

EXAMPLE 5

Laser scanner full-colour picture production - screened

The procedure as described in Example 4 was followed, with the following variations:

(i) the power of the output laser was chosen to print a full-density transfer image of each colour, and

(ii) in order to simulate a situation in which the signals derived from the read-head of the scanner are electronically analysed, and converted into digital form before being fed to the output laser modulator, a pre-screened, i.e. dot image, was read by the scanner. Thus, the output laser was switched between zero and full-density output power by a digitised signal, with the result that a picture was produced which consisted of dots of transferred dyes, each dot being of maximum transferred dye density, but the size and distribution of the dots determining the varying tonal values of the picture.

CLAIMS

1. A process for preparing a full-colour image of an object on a receptor sheet which comprises analysing the object to obtain a set of signals which is representative of the shape and colour of the object, sequentially contacting three or more dyes carried on donor sheets with the receptor sheet and transferring said dyes imagewise onto the receptor sheet to form a full-colour image of the object, the dyes being transferred by heating with a scanning laser beam to volatilise the dyes, the laser beam being modulated by said set of signals which is representative of the shape and colour of the object so that each dye is heated to cause volatilisation only in those areas in which its presence is required on the receptor sheet to reconstruct the colour of the object, characterised in that:

(i) the wavelength of the laser emission is less than 2.5 μ,

(ii) each donor sheet comprises a support sheet, substantially transparent to said laser emission bearing on its major surface a dye layer comprising at least one dye which is vaporisable at a temperature in the range 120 to 250°C and a heat-resistant binder which is substantially transparent to said laser, each donor sheet having a material which strongly absorbs the wavelength of the laser emission distributed throughout the dye layer and/or in a separate layer interposed between said major surface of the support and dye layer in an amount to absorb a substantial proportion of the incident laser radiation, and

(iii) the receptor is heated to a temperature of from 120 to 250°C at least after the final dye transfer stage to stabilize the dye image.

2. A process as claimed in Claim 1, in which the dyes are sublimable in the range 150 to 220°C.

3. A process as claimed in Claim 1 or Claim 2, in which the receptor is heated to a temperature of from 120 to 250°C at least after the final dye transfer stage for a period of from 0.01 to 30 seconds.

4. A process as claimed in any preceding claim, in which the receptor is heated to a temperature of from 160 to 180°C for a period of from 0.5 to 1 seconds at least after the final dye transfer stage.

5. A process as claimed in any preceding claim, in which the receptor is heated after each dye transfer stage.

6. A process as claimed in any preceding claim, in which the laser has a wavelength above 0.2 μ.

7. A process as claimed in Claim 6, in which the laser has a wavelength in the range 0.75 to 2.5 μ.

8. A process as claimed in any preceding claim, in which the laser is an Nd:YAG laser emitting at 1.06 μ.

9. A process as claimed in any preceding claim, in which the material which strongly absorbs the wavelength of the laser comprises finely divided carbon.

10. A process as claimed in any preceding claim, in which the material which strongly absorbs the wavelength of the laser emission is contained in a separate layer on the donor.

11. A process as claimed in any preceding claim, in which the material which strong absorbs the wavelength of the laser is present in an amount sufficient to absorb at least 60% of the incident laser beam energy.

12. A process as claimed in Claim 11, in which said material is present in an amount to absorb about 90% of the incident laser beam energy.

13. A process as claimed in Claim 12, in which said material is preset in an amount to absorb about 99% of the incident laser beam energy.

14. A process as claimed in any preceding claim, in which the laser output power is varied continuously as a function of the colour information obtained by analysing the object.

15. A process as claimed in any one of Claims 1 to 13 in which the laser output is operated in a screened mode utilising a digital signal to transfer dots of dye of equal density but varying in size as a function of the colour information obtained by analysing the object.

16. A process as claimed in any preceding claim, in which the receptor sheet has a surface coating of a dye receptive medium.

17. A process as claimed in Claim 16, in which the dye receptive medium comprises a readily dyeable polymer and/or an absorbent particulate material and/or a dye fixing agent.

18. A process as claimed in Claim 17, in which the surface coating is formed from a dispersion comprising:

80 parts by weight ethylmethyl ketone,
9.8 parts by weight vinyl chloride/acetate resin,
7.9 parts by weight silica, and
2.3 parts by weight nickel stearate.

19. A process as claimed in any preceding claim, in which the heat treatment is effected by contacting the imaged surface of the receptor sheet with a heated platen or roller.

20. A process as claimed in any preceding claim, in which the three dyes are cyan, magenta and yellow.

21. A process as claimed in any preceding claim, which includes a fourth transfer stage in which black colour is transferred.

22. A process as claimed in Claim 1 substantially as herein described with reference to the Examples.

23. A donor sheet comprising a support, which is substantially transparent to infrared radiation, bearing on a major surface thereof a dye layer containing at least one dye which is vaporisable at a temperature in the range 120 to 250°C, the donor sheet having a material which strongly absorbs radiation in the range 0.2 to 2.5 μ distributed throughout the dye layer and/or in a separate layer interposed between said major

surface of the support and dye layer.

24. A donor sheet as claimed in Claim 23 in which the dye is a sublimable at a temperature in the range 120 to 250°C.

25. A donor sheet as claimed in Claim 23 or Claim 24, in which the material is finely divided carbon.

26. A donor sheet is claimed in Claim 25, in which the carbon is present in a separate layer between the support and dye layer.

27. A set of three donor sheets as claimed in any one of Claims 23 to 26 in which the dye layers of said sheets contain a magenta dye, a cyan dye and a yellow dye, respectively, the dyes being selected such that substantially all the colours of the visible spectrum may be reproduced by any suitable combination thereof.

28. A set of four donor sheets, comprising three donor sheets as claimed in Claim 27, and a fourth donor sheet which contains a transferrable black colour consisting of a balanced combination of magenta, cyan and yellow dyes.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1982.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.